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INFO-0218

LICENSING OF URANIUM MINE AND MILL WASTE MANAGEMENT SYSTEMS

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September 1986

Canada

Paper

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Presented at
The Canadian Nuclear Society
International Conference on
Radioactive Waste Management
September 1986

ABSTRACT

Systems for the management of wastes arising from uranium mining facilities are subject to regulatory control by the Atomic Energy Control Board (AECB). This paper describes the primary objectives, principles, requirements and guidelines which the AECB uses in the regulation of waste management activities at uranium mining facilities, and provides an understanding of the licensing process used by the AECB.

RÉSUMÉ

Les systèmes de gestion des déchets provenant des installations d'extraction minière d'uranium font l'objet d'un contrôle réglementaire par la Commission de contrôle de l'énergie atomique (CCEA). Le présent document décrit les principaux objectifs, principes, exigences et lignes directrices qu'utilise la CCEA pour la réglementation des activités de gestion des déchets aux installations d'extraction minière d'uranium, en plus de fournir des précisions sur le régime de permis de la CCEA.

LICENSING OF URANIUM MINE AND MILL WASTE MANAGEMENT SYSTEMS

1. BACKGROUND

The AECB regulates the development, application and use of atomic energy in Canada. Systems for the management of wastes arising from pre-development, siting and construction, operation or decommissioning of uranium mining facilities therefore are subject to regulatory control by the AECB, under the authority of the Atomic Energy Control (AEC) Act.

The objectives of this paper are to assist industry and the public in understanding the licensing process used by the AECB, and to describe and consolidate the primary objectives, principles, requirements and guidelines which the AECB uses in the regulation of uranium mine and mill waste management systems. Using the systems approach, the major waste management licensing responsibilities, requirements and guidelines inherent at each stage of a uranium mining project are examined. Specific emphasis is placed on the tailings containment and liquid waste treatment components of the overall waste management system.

For additional details on the licensing process, the reader is referred to relevant AECB regulatory Consultative Documents, including C-36 which addresses the licensing process and regulatory requirements for waste management systems at uranium mining facilities(1), C-95 which prescribes maximum acceptable levels of contamination on equipment and materials leaving uranium mine facilities(2), C-90 which addresses AECB policy on the decommissioning of nuclear facilities(3), and C-104 which outlines regulatory criteria for the disposal of radioactive wastes.

2. REGULATORY APPROACH

AECB regulatory control is achieved through a comprehensive licensing process designed to assure proper consideration of health and safety, environmental protection and security. In exercising its responsibilities, the AECB establishes requirements, assesses potential licensees' capabilities to meet these requirements and to assure their maintenance and, subsequent to issuance of a licence, conducts compliance and inspection activities.

Emphasis is placed on developing a consultative regulatory approach, involving other government agencies, industry and the public. The AECB has established working arrangements with federal and provincial agencies which have relevant regulatory jurisdiction in health and safety and environmental protection.

The regulatory objective of the AECB with respect to waste management systems is to ensure that liquid, solid and gaseous wastes are managed in a manner which protects the health and safety of persons, and the environment. Regulatory requirements are established by the AECB to ensure that the licensee achieves this objective. Guidelines established by the AECB are advisory in nature and are an aid to the licensee in the interpretation of requirements.

Principles applied by the AECB in establishing the requirements for waste management systems include the following:

(a) all doses shall be kept as low as reasonably achievable, social and economic factors being taken into account (ALARA);

(b) maximum permissible doses of ionizing radiation and exposures to radon daughters specified in the AEC Regulations shall be observed;

(c) any unacceptable impact on the environment shall be avoided by the containment and isolation of wastes to the extent practicable;

(d) any release of contaminants shall be controlled in such a manner that the environment is capable of assimilating them and of minimizing their potential impact through natural processes;

(e) responsibility for waste management shall be undertaken at the present and not left to future generations or future technologies;

(f) future generations shall not be subjected to any greater risk than is acceptable to current society; and

(g) methods for the disposal of wastes shall, to the extent practicable, minimize dependence on active institutional controls as a means of ensuring their success.

3. WASTE MANAGEMENT SYSTEM

The AECB has found it useful to regulate waste management activities at uranium mining facilities by way of a systems assessment approach within a life-stage approval framework.

A uranium mine and mill waste management system is composed of all components for collecting, transporting, receiving, processing, treating, storing and disposing of wastes. These components may be distinguished on the basis of their functions as well as differences in materials, structures and processes. The waste management system incorporates some or all of the following activities:

(a) management of surface water and ground-water;
(b) handling and treatment of minewater;
(c) management of waste rock;
(d) handling and transport of tailings and liquid waste;
(e) containment of tailings and primary treatment of liquid waste;
(f) secondary treatment of liquid waste;
(g) management of waste from ore stockpiles;
(h) management of particulate and gaseous airborne contaminants; and
(i) management of miscellaneous waste.

The component of main interest is that involved in the containment of tailings and primary treatment of liquid waste. The primary functions of the system for tailings containment and primary treatment are to contain solid mill wastes and to provide for solid-liquid separation prior to secondary treatment of the decant. Basic design and operating objectives for this system are provision of a containment system which is both physically and chemically stable and control of the release of wastes to acceptable levels.

Conventional mill tailings containment is generally accomplished by means of dams, berms, embankments and other engineered structures, in association with natural basins or other topographic features. Other methods of tailings containment may include placement in underground mines, placement in open pit mine excavations, deposition in lacustrine environments and below-grade deposition in natural or engineered cavities.

4. LICENSING PROCESS

General

Uranium mine and mill waste management systems are regulated through the licensing process applicable to nuclear facilities in general, and mining facilities in particular. Information and supporting documentation required in the licensing of the waste management system usually are provided with applications submitted by a proponent for the licensing of a mining facility.

The life of a uranium mining facility, and its associated waste management system, is characterized by a series of distinct stages: (a) pre-development; (b) siting and construction; (c) operation; and (d) decommissioning and subsequent abandonment. Accordingly, licences or approvals may be issued for each of these life stages following regulatory review of proposed systems and procedures. Figures 1 through 5 depict a general schedule of anticipated activities within this licensing process for a waste management system.

5. PRE-DEVELOPMENT

Proponents are encouraged to initiate a dialogue with the AECB as early as possible in the conceptual planning stage of a new system or mining facility. Early contact and discussion help to ensure that proper procedures are established for the transfer of information between a proponent and the AECB.

Depending on their nature, pre-development activities at an exploration site may be licensed by the AECB, through either an Ore Removal Permit (ORP) or an Underground Exploration Permit (UEP). An ORP is required if there is removal of uranium or thorium in excess of 10 kilograms (kg) for the expressed purpose of their recovery or metallurgical testing. A UEP is required when significant excavation work is proposed, or when there is a likelihood of radiation exposure to persons or of environmental impact.

Figures 1 and 2 outline a general schedule of activities inherent to the licensing process for, respectively, ORPs and UEPs.

Application for an ORP must include information relevant to waste management concerns, such as the location and general description of the site, the activities to be conducted, the procedures to be followed in the event of accidental or unscheduled releases of contaminants and a description of the program for monitoring any release of contaminants from the facility.

	PROPONENT	AECB
PRE-LICENCE	· Dialogue with AECB · Submit application with support documentation, including: · description of site · description of proposed activities · monitoring and contingency plans	· Consult with agencies · Review application · Issue licence
POST-LICENCE	· Comply with licence · Submit: · monitoring reports · annual reports	· Review monitoring reports and annual reports · Undertake compliance inspections

Figure 1: LICENSING PROCESS - ORE REMOVAL PERMIT

	PROPONENT	AECB
PRE-LICENCE	· Dialogue with AECB · Submit application with support documentation, including: · description of site · description of proposed activities · monitoring and contingency plans · conceptual decommissioning plans · environmental baseline information · environmental impact overview	· Consult with agencies · Review application · Issue licence
POST-LICENCE	· Comply with licence · Submit: · monitoring reports · annual reports	· Review monitoring reports and annual reports · Undertake compliance inspections

Figure 2: LICENSING PROCESS - UNDERGROUND EXPLORATION PERMIT

Application for a UEP must include such information as outlined above for an ORP, as well as an environmental impact overview, proposed measures for preventing or controlling the release of contaminants from the facility and conceptual decommissioning plans.

The environmental impact overview must contain a description of proposed activities at the site and an assessment of the probable effects and impacts of these activities upon health and safety and upon the environment. The purpose is to identify environmental effects arising from the proposed activities, to evaluate the significance of the predicted environmental impacts and to identify measures needed to prevent or mitigate unacceptable impacts. A description of current environmental conditions should be provided.

Both the ORP and UEP may contain such terms and conditions as the AECB considers necessary in the interests of health and safety, protection of the environment and security. These may include conditions respecting the maximum quantity and concentration of contaminants that may be released, the monitoring programs to be established, the measures to be taken to prevent or to control radiation hazards arising from wastes at the site and the methods of disposing of any radioactive wastes.

Post-licensing regulatory control is facilitated through compliance inspections and review of monitoring reports and Annual Reports submitted by the licensee.

6. SITING AND CONSTRUCTION

General

In the regulation of nuclear facilities, the AECB normally reviews the proposed facility concept when approval to site and construct is sought. Site and construction approval is contingent upon submission and review of an application containing such information as design and construction plans, general operating procedures, assessment of environmental impacts, and monitoring, contingency and decommissioning plans. Generally, the conceptual design of the facility is approved at this stage, with the detailed design being reviewed and approved as it becomes available during construction. This process recognizes and accommodates the fact that detailed designs are generally not obtainable at the time an application to site and construct is submitted.

Figure 3 outlines a general schedule related to licensing of siting and construction activities.

	PROPONENT	AECB

PRE-LICENCE	• Dialogue with AECB
	• Submit application with support documentation, including:
	  • principal plans and design
	  • environmental baseline information
	  • environmental impact assessment, including preliminary pathway analysis
	  • monitoring and contingency plans
	  • conceptual decommissioning plans
	• Public information process
		• Consult with agencies
		• Review application
		• Issue licence

POST-LICENCE	• Comply with licence
	• Submit:
	  • detailed design of systems
	  • construction reports
	  • monitoring reports
	  • annual reports
		• Review for approval:
		  • detailed design of system
		  • construction reports
		  • monitoring reports
		  • annual reports
		• Undertake compliance inspections

Figure 3: LICENSING PROCESS - SITE AND CONSTRUCTION LICENCE

The assessment of potential impacts of the facility on public health and safety and on the environment must include a description of the assessment methodology, a summary description of the facility including site characteristics and operating procedures, baseline information on those parts of the environment which may significantly affect or be significantly affected by the facility, and an outline of proposed remedial or mitigative measures for potentially significant impacts.

The assessment process should identify and predict the magnitude and importance of environmental effects in order to provide recommendations on facility design, mitigative measures, monitoring programs and contingency plans. The proposed activities should be described in sufficient detail to enable a clear prediction and understanding of resulting environmental effects. Baseline environmental information should provide a description of the key aspects of the environment, from studies and investigations of geomorphology, geology, meteorology, surface hydrology, hydrogeology, ecology and land use. A preliminary pathway analysis should be undertaken to assess the impact of contaminant releases upon public health and safety and upon the environment. The results will be reviewed by the AECB in assessing the acceptability of a proposal.

In the absence of an appropriate environmental review process administered by provincial or territorial agencies, the AECB may initiate a referral for public review through the federal Environmental Assessment Review Process (EARP).

An applicant must complete a public information process prior to receiving AECB approval to site and construct a facility. The purpose of the public information process is to inform persons living in the vicinity of the proposed mining facility of the general nature and characteristics of the anticipated effects and impacts of that facility. The process may involve public displays, the distribution of information describing the proposal and public meetings.

The waste management system proposed by an applicant should be defined in sufficient detail to support a siting decision. The selection of a suitable site should be based upon an evaluation of design parameters and baseline environmental data. Any potential siting constraints should be identified as an aid in designing waste containment, monitoring and control measures. Appropriate design measures should be used to address any limitations and deficiencies of the site selected. Appendix 1 outlines considerations to be incorporated into the design of a waste management system.

All construction should follow good engineering practice and must be conducted in accordance with the approved design. Periodic progress reports outlining quality assurance data, design changes and schedule changes are required to be submitted to the AECB.

Site and construction approvals may contain such terms and conditions as the AECB considers necessary in the interests of health and safety, protection of the environment and security, including those outlined above for ORPs and UEPs.

Regulatory control is facilitated through compliance inspections and review of monitoring reports, construction reports and Annual Reports submitted by the licensee.

Tailings Containment System

The applicant should identify potential sites for location of the tailings containment system and conduct preliminary investigations on each. The preferred site should be chosen on the basis of an assessment of the strengths and weaknesses of each potential site. Primary considerations in the site selection process for a tailings containment system are:

(a) adequate areal extent to accommodate the anticipated volume of solids;

(b) effective utilization of the catchment area;

(c) capability of underlying materials to support tailings containment structures and the contained wastes, without undue settlement;

(d) amenability to diversion of upstream catchment run-off;

(e) protection against erosion and other destabilizing geomorphic processes; and

(f) capability of underlying materials to limit the movement of leachate into the groundwater system, or their amenability to engineering modification to achieve this end.

Primary consideration in the design of a tailings containment system are:

(a) provision of appropriately designed works for waste containment and for control over release of contaminants;

(b) requirements and objectives for decommissioning;

(c) provision of sufficient depth, capacity and retention time for effective settlement of solids during peak flow periods;

(d) provision of an adequate design freeboard which allows for solids deposition, normal process flows and waves;

(e) notwithstanding the above, provision of an adequate design freeboard for the safe storage or routing of runoff resulting from the probable maximum precipitation (PMP) without causing overtopping of the dam or embankment crests; and (f) incorporation of underdrains, toe drains, filters or other necessary features, as determined by appropriate seepage analyses, to ensure embankment integrity.

7. OPERATION

General

A Mine Facility Operating Licence (MFOL) issued by the AECB provides for regulatory control of the operation of a waste management system. A written application for an MFOL must be submitted to the AECB. Appendix 2 outlines information relevant to waste management concerns that must be included in the application.

A general schedule of licensing activities related to operation of a waste management system is depicted in Figure 4.

	PROPONENT	AECB

PRE-LICENCE	• Dialogue with AECB
	• Submit application with support documentation, including:
	  • description of anticipated waste discharges
	  • update of previously submitted information
		• Consult with agencies
		• Review application
		• Issue licence

POST-LICENCE	• Comply with licence
	• Submit:
	  • as-built plans
	  • monitoring reports
	  • spill reports
	  • annual reports
	• Application for licence renewal
		• Review for approval:
		  • as-built plans
		  • monitoring reports
		  • spill reports
		  • annual reports
		• Undertake compliance inspections
		• Review licence renewal application

Figure 4: LICENSING PROCESS - OPERATING LICENCE

The MFOL may contain such terms and conditions as the AECB considers necessary in the interests of health and safety, protection of the environment and security. These may include conditions respecting the maximum quantity and concentration of contaminants that may be released, the monitoring programs to be established, the measures to be taken to prevent or to control radiation hazards arising from wastes at the site and the methods of disposing of radioactive or other hazardous material.

The licensee must provide for the management of wastes according to the approved design, particularly in respect of:

(a) re-use of liquid waste;

(b) segregation of clean water from contaminated water;

(c) limitation of the release of liquid waste through seepage;

(d) control of the release of wastes from the facility;

(e) assurance that liquid waste to be released from the facility meets prescribed quality limits;

(f) minimization of the number of points of release of wastes from the facility;

(g) containment and stabilization of solid waste; and

(h) limitation of the release of particulate and gaseous airborne contaminants within and from the facility.

It is recommended that the licensee prepare and submit an operating manual for the waste management system. An outline of general operating procedures, inspection and maintenance programs, and contingency plans should be included in this manual.

Monitoring programs and contaminant release limits are derived through a consultative process between the licensee, other relevant agencies and the AECB. Site-specific release limits are based on AECB dose and exposure limits, federal Metal Mining Liquid Effluent Regulations and Guidelines, and provincial release limits and objectives for the receiving environment quality.

In the event of any significant accidental or unscheduled release of contaminants from or within the mining facility, the appropriate remedial measures must be implemented and the AECB notified forthwith. A detailed report describing the nature, extent and probable cause of the event, remedial actions taken to mitigate the consequences of the event and any additional measures proposed must be submitted to the AECB as soon as possible after the event.

Post-licensing regulatory control is facilitated through compliance inspections and review of monitoring reports and Annual Reports submitted by the licensee. Appendix 3 outlines Annual Report information requirements relevant to waste management concerns.

Tailings Containment System

The development of operating procedures for the tailings containment system should give consideration to the following:

(a) maintaining control over discharge of waste to the system, with the intent of optimizing solids-liquid separation;

(b) reducing the possibility of erosion, seepage or overtopping of embankment and dam faces;

(c) maintaining appropriate control of the physical, chemical and radiological characteristics of discharges from primary treatment;

(d) maintaining appropriate control over releases of particulate and gaseous airborne contaminants;

(e) managing any contaminated seepage considered unacceptable for release to the environment; and

(f) maintaining adequate freeboard.

Monitoring programs for tailings containment systems should be designed to provide regular assessment of:

(a) mass and volume of wastes discharged to the system;
(b) water level of any tailings pond;
(c) quantity and quality of decant outflow;
(d) extent and quality of seepage releases;
(e) particulate and gaseous airborne contaminant releases; and
(f) integrity of all structures and works inherent to the system.

8. DECOMMISSIONING

General

Decommissioning of a mining facility or any associated waste management system implies all those actions taken to retire that facility or system permanently from operation. Figure 5 outlines a general schedule of licensing activities related to decommissioning of a waste management system. For additional guidance, the reader is referred to AECB Consultative Document C-90 which addresses AECB policy on the decommissioning of nuclear facilities (3), and Consultative Document C-104 which outlines regulatory criteria for the disposal of radioactive wastes.

	PROPONENT	AECB

PRE-LICENCE	• Dialogue with AECB
	• Submit application with support documentation, including:
	  • decommissioning plans
	  • pathway analysis
	  • performance monitoring program
		• Consult with agencies
		• Review application
		• Issue licence

POST-LICENCE	• Comply with licence
	• Implement plans
	• Submit:
	  • monitoring reports
	  • annual reports
	• Submit application to abandon
		• Review for approval:
		  • monitoring reports
		  • annual reports
		• Undertake compliance inspections
		• Review application to abandon
		• Issue approval to abandon

Figure 5: LICENSING PROCESS - DECOMMISSIONING LICENCE

Decommissioning must be undertaken in accordance with a licence issued by the AECB. A written application to decommission must be submitted to the AECB, supported by such information as outlined in Appendix 4. The decommissioning licence may contain such terms and conditions as the AECB considers necessary

in the interests of health and safety, protection of the environment and security.

The final decommissioning plan will normally be based upon conceptual plans previously submitted by the licensee and upon discussions with the AECB. In conjunction with general decommissioning requirements, performance and procedural criteria specific to the decommissioning of the facility may be prescribed.

Reliance on active institutional controls for the protection of public health and safety and the environment is to be minimized. The AECB requires that a licensee consider alternative decommissioning actions that might be taken to avoid the need for institutional controls. In general, controls which require ongoing human intervention (as would be required for effluent treatment) will not be acceptable. On the other hand, more static mechanisms such as land use controls may be acceptable.

The results of the decommissioning monitoring program are used in the assessment of the effectiveness of decommissioning activities. Compliance with applicable air and water quality criteria at designated points in the environment surrounding the facility, prior to abandonment, may be required.

Post-licensing regulatory control is facilitated through compliance inspections and review of monitoring reports and Annual Reports submitted by the licensee.

Written approval from the AECB is required before a facility may be abandoned. The AECB may issue such an approval where it is satisfied that the licensee has successfully decommissioned the facility in accordance with the decommissioning licence.

In arriving at a decision on approval to abandon, the AECB will assess the effectiveness of decommissioning methods and procedures undertaken by the licensee, and will review the results of performance monitoring. After a licensee has successfully met both the general and site-specific requirements, the licensee's responsibility for the facility under the AEC Act and Regulations is considered to have been discharged.

Tailings Containment System

The following should be considered when developing decommissioning plans for a tailings containment system:

(a) effective drainage of surface runoff;

(b) effective tailings consolidation and stabilization;

(c) isolation of contaminated material, using natural materials where possible;

(d) minimization of the release of particulate and gaseous airborne contaminants;

(e) use of appropriate factors of safety to address the long-term integrity of structure;

(f) removal and treatment, as necessary, of residual liquid wastes; and

(g) sealing of decant structure which pass through embankments, dams or foundations.

9. CONCLUSION

The AECB utilizes a comprehensive licensing process in the regulation of waste management activities at uranium mining facilities. This process is designed to assure proper consideration of health and safety, environmental protection and security.

Requirements and guidelines have been established to recognize and respond to site-specific variations between facility sites, and between proposed designs. On-going dialogue between a licensee and the regulatory agencies therefore is essential to the licensing system. In this regard, clarification and communication of AECB regulatory requirements and guidelines pertaining to uranium mine and mill waste management systems is beneficial to both current and future licensees, and to the public.

REFERENCES

(1) Consultative Document C-36, "A Guide to the Licensing of Uranium and Thorium Mine and Mill Waste Management Systems", Proposed Regulatory Guide, Atomic Energy Control Board, Canada, June 1986.

(2) Consultative Document C-95, "Policy Statement on Maximum Acceptable Levels of Contamination on Equipment and Materials Leaving Uranium Mine Facilities", Proposed Regulatory Policy Statement, Atomic Energy Control Board, Canada, March 1986.

(3) Consultative Document C-90, "Policy on the Decommissioning of Nuclear Facilities", Proposed Regulatory Policy Statement, Atomic Energy Control Board, Canada, October 1985.

(4) Consultative Document C-104, "Regulatory Objectives, Requirements and Guidelines for the Disposal of Radioactive Wastes", Proposed Regulatory Policy Statement, Atomic Energy Control Board, Canada, April 1986.

APPENDIX 1

DESIGN CONSIDERATIONS FOR WASTE MANAGEMENT SYSTEMS

- Use of natural features and materials
- Re-use of liquid waste
- Limitation of the use of fresh water
- Separation of clean and contaminated water in order to minimize the amount of contaminated water produced
- Provision for measurement of the quantity and quality of contaminant releases from the mining facility
- Measures for controlling the release of contaminants from the mining facility
- Minimization of the number of points of release of wastes from the mining facility
- Containment and treatment of liquid wastes
- Containment and stabilization of solid wastes
- Provision for inspection, testing and maintenance of all systems
- Mitigation of potentially detrimental impacts upon workers and public health and safety and upon the environment
- Provision for operational and post-operational stability and integrity of the systems
- Requirements for decommissioning

APPENDIX 2

MFOL APPLICATION - WASTE MANAGEMENT INFORMATION

- Detailed description of the design and operation of the waste management system and mining facility
- Anticipated total volume and flow rates of liquid waste to be release from the facility, with an identification of all points of release
- Quantity and characteristics of any liquid, solid or gaseous waste expected to be generated from operation of the facility
- Quantity and characteristics of any liquid, solid or gaseous contaminants expected to be released from the facility
- Identification of anticipated liquid and solid waste streams within mining facility

- Detailed description of plans for monitoring the release of contaminants from the facility and for monitoring the receiving environment
- Identification of potential scenarios resulting in significant accidental or unscheduled releases of contaminants, and proposed contingency and remedial measures to respond to and manage any such releases
- Conceptual decommissioning plans
- Measures proposed to prevent or control radiation doses to workers involved in waste management activities

APPENDIX 3

ANNUAL REPORT - WASTE MANAGEMENT INFORMATION

- Description of any significant changes to the waste management system
- Description of the quantity and characteristics of wastes discharged to the tailings containment area
- Estimate of the current volume and mass of solid waste generated and retained at the facility
- Summary of the operation of the waste treatment system
- Summary of the quantity and characteristics of contaminant releases from the facility
- Description of significant repairs and maintenance conducted on the waste management system
- Description of each event or occurrence which resulted in or would be likely to result in a significant risk to the environment or to public health and safety, with the corrective measures taken or proposed to remedy these problems
- Description of all activities conducted with respect to stabilization or isolation of wastes
- Summary and analysis of monitoring information

APPENDIX 4

INFORMATION REQUIREMENTS FOR A DECOMMISSIONING LICENCE

- Notification of the proposed date of the start of decommissioning
- Description of the actions proposed to be taken to decommission the facility, including a schedule

- Justification for any planned delays or deferment of action in the schedule
- Description of actual or anticipated radiation levels and the quantities and types of radioactive prescribed substances present in the facility, and the concentration of radioactive prescribed substances on surfaces, in water and in air
- Description of the anticipated inventory of radioactive waste and toxic wastes arising from the decommissioning of the facility, and the place and manner in which it is proposed to dispose of such wastes
- Details of a quality assurance program for the decommissioning of the facility
- Description of the hazards that might result from the decommissioning of the facility, and of the measures to be taken to ensure appropriate dose limits are observed or to prevent or minimize other hazards involved in the decommissioning
- Description of the predicted impact of the decommissioning operations, and of the residual hazardous substances, on the environment and on public health and safety, together with an estimate of the residual radiation levels and the quantities and types of residual hazardous substances
- Details of any institutional controls that may be required
- Description of the proposed monitoring program to assess the effectiveness of the decommissioning activities